

U.S. Application No.: 10/034,097
Amendment Under 37 C.F.R. §1.111 dated August 6, 2004
Response to the Office Action of April 7, 2004

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (Currently Amended): A method for controlling a tool changer which comprises a changer arm having a spindle tool holder provided on one end thereof for holding a tool attached to a main spindle and a standby tool holder provided on the opposite end thereof for holding a tool to be next attached to the main spindle for tool change ~~and is adapted to pivot the changer arm by a driving system including a servo motor to exchange the tool attached to the main spindle in a tool changing position and the next tool in a predetermined position~~, the method comprising ~~the steps of:~~

preliminarily pivoting both the spindle tool holder and the standby tool holder of the changer arm toward the tool changing position by a predetermined angle to an intermediate position before a tool changing position while the main spindle is moved to the tool changing position;

further pivoting the changer arm from said intermediate position by a residual angle in a direction of said preliminary pivoting so as to move the spindle tool holder of the changer arm to the tool changing position after the main spindle reaches the tool changing position; and

causing the spindle tool holder of the changer arm to hold the tool attached to the main spindle.

Claim 2 (currently amended): A method as set forth in claim 1,

~~wherein, when the main spindle is located on a same side as the spindle tool holder of the changer arm with respect to a plane including a pivot axis of the changer arm and the tool changing position prior to the movement to the tool changing position, the predetermined preliminary pivot angle is smaller than the predetermined preliminary pivot angle when the main spindle is located opposite from the spindle tool holder with respect to the plane prior to the movement to the tool changing position~~

wherein said preliminary pivoting pivots the changer arm to the intermediate position by a first predetermined angle when the main spindle starts moving towards the tool changing position from a first area, and pivots the changer arm to the intermediate position by a second predetermined angle smaller than the first predetermined angle when the main spindle starts moving towards the tool changing position from a second area different from the first area, the second area being closer to the spindle tool holder than the first area.

Claim 3 (Currently Amended): An apparatus for controlling a tool changer which comprises a changer arm having a spindle tool holder provided on one end thereof for holding a tool attached to a main spindle and a standby tool holder provided on the opposite end thereof for holding a tool to be next attached to the main spindle for tool change and is adapted to pivot the changer arm by a driving system including a servo motor to exchange the tool attached to the main spindle in a tool changing position and the next tool in a predetermined position, the

apparatus comprising a drive controlling section for driving the servo motor to perform a changer arm pivoting control process comprising the steps of:

preliminarily pivoting both the spindle tool holder and the standby tool holder of the changer arm toward the tool changing position by a predetermined angle to an intermediate position before a tool changing position while the main spindle is moved to the tool changing position;

further pivoting the changer arm from said intermediate position by a residual angle in a direction of said preliminary pivoting so as to move the spindle tool holder of the changer arm to the tool changing position after the main spindle reaches the tool changing position; and

causing the spindle tool holder of the changer arm to hold the tool attached to the main spindle.

Claim 4 (currently amended): An apparatus as set forth in claim 3,

~~wherein, when the main spindle is located on a same side as the spindle tool holder of the changer arm with respect to a plane including a pivot axis of the changer arm and the tool changing position prior to the movement to the tool changing position, the predetermined preliminary pivot angle is smaller than the predetermined preliminary pivot angle when the main spindle is located opposite from the spindle tool holder with respect to the plane prior to the movement to the tool changing position~~

wherein said preliminary pivoting pivots the changer arm to the intermediate position by a first predetermined angle when the main spindle starts moving towards the tool changing

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position from a first area, and pivots the changer arm to the intermediate position by a second predetermined angle smaller than the first predetermined angle when the main spindle starts moving towards the tool changing position from a second area different from the first area, the second area being closer to the spindle tool holder than the first area.